

REMARKS

This is intended as a full and complete response to the Office Action dated April 1, 2003 having a shortened statutory period for response set to expire on July 1, 2003. Claims 27-76 stand rejected. Please reconsider the pending claims for reasons discussed below.

Claim 67 stands rejected under 35 U.S.C. § 102(e) over *Kaisaki et al.* (U.S. Patent No. 6,194,317) on grounds that the oxalic acid complexing agent disclosed in *Kaisaki et al.* is equivalent to the claimed reducing agent. Applicants respectfully traverse this rejection on grounds that *Kaisaki et al.* does not teach, show, or suggest polishing a substrate with a barrier-layer-selective composition comprising a reducing agent.

Kaisaki et al. discloses that complexing agents are useful in the polishing of copper. *Kaisaki et al.* states that the "oxidation and dissolution of copper metal can be enhanced by the addition of complexing agents...These compounds can bond to copper to increase the solubility of copper metal or copper oxides in water..." (See, col. 13, Ins. 57-61.) *Kaisaki et al.* is silent on utilizing complexing agents for polishing barrier layer materials, such as a tantalum-comprising material. In addition, *Kaisaki et al.* teaches away from polishing a substrate with a barrier-layer-selective composition comprising a reducing agent. According to *Kaisaki et al.*, complexing agents, such as oxalic acid, enhances the removal of copper. Thus, under the teachings of *Kaisaki et al.*, one would not utilize oxalic acid in a polishing composition selective to the removal of the barrier layer because oxalic acid would cause increased polishing of exposed copper features instead of the barrier layer material and would cause dishing of the exposed copper features. Therefore, *Kaisaki et al.* does not teach, show, or suggest polishing the substrate with a barrier-layer-selective composition comprising at least one reducing agent to remove the exposed portions of the barrier layer. As a consequence, Applicants respectfully submit that claim 67 and its dependent claims are patentable over *Kaisaki et al.* Withdrawal of the rejection is respectfully requested.

Claims 27-32, 35-66, 68, 69, and 70-76 stand rejected under 35 U.S.C. § 103(a) over *Kaisaki et al.* (U.S. Patent No. 6,194,317) in view of *Merchant et al.* (U.S.

6,436,830) on grounds that one skilled in the art would have found it obvious that the *Kaisaki* step of polishing the copper would have produced copper ions in the working liquid/composition in view of the *Merchant* teaching because *Merchant et al.* states that the metal particles polished from the metal layer may form copper ions in the slurry. Applicants respectfully traverse this rejection on grounds that both the references teach away from the methods as claimed.

As discussed above, *Kaisaki et al.* discloses that complexing agents are useful in the polishing of copper. *Merchant et al.* discloses a CMP slurry emulsion comprising an organic phase 14. (See, Figure 1.) The purpose of the organic phase 14 is to capture metal particles polished off the metal layer 22 and to transport copper complexes away from the wafer 20. (See, col. 4, Ins. 30-44.) As discussed above, *Kaisaki et al.* teaches away from utilizing oxalic acid in a polishing composition selective to the removal of barrier layer materials, such as a tantalum-comprising material, rather than a conductive materials, such as a copper-comprising material, under the teachings of *Kaisaki et al.*, oxalic acid would cause increased polishing of exposed copper features instead of the barrier layer material. *Merchant et al.* discloses that it is beneficial that copper ions be removed from the wafer surface rather than applied thereto. Thus, *Merchant et al.* teaches away from contacting a surface of a substrate with a composition comprising transitional metal ions to aid in the selectivity of a barrier layer material, such as a tantalum-comprising material. As a consequence, *Kaisaki et al.* and *Merchant et al.*, either alone or in combination, do not teach, show, or suggest polishing the substrate with a barrier-layer-selective composition comprising at least one reducing agent to remove the exposed portions of the barrier layer. Withdrawal of the rejection is respectfully requested.

In conclusion, the reference cited by the Examiner does not teach, show, or suggest the methods of the present invention. Having addressed all issues set out in the office action, Applicants respectfully submit that the claims are in condition for allowance and respectfully request that the claims be allowed.

Respectfully submitted,



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